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मानक

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IS 7451-2 (2006): Reciprocating Internal Combustion Engines, Part II: Designation of the direction of rotation and of cylinders and valves in cylinder heads, and definition of right-hand and left-hand in-line engines and locations on an engine (Amalgamating Part 3,4and5) [TED 2: Automotive Primemovers]



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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
प्रत्यागामी आंतरिक दहन इंजन

भाग 2 सिलिंडर के शीर्ष में घूर्णन, सिलिंडरों और वाल्वों की दिशा के नामन तथा
दाएं एवं बाएं इन-लाइन इंजनों और इंजनों के स्थलों की परिभाषा
(पहला पुनरीक्षण)

Indian Standard

RECIPROCATING INTERNAL COMBUSTION ENGINES

**PART 2 DESIGNATION OF THE DIRECTION OF ROTATION AND OF CYLINDERS AND
VALVES IN CYLINDER HEADS, AND DEFINITION OF RIGHT-HAND AND LEFT-HAND
IN-LINE ENGINES AND LOCATIONS ON AN ENGINE**

(First Revision)

ICS 27.020

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

NATIONAL FOREWORD

This Indian Standard (First Revision) which is identical with ISO 1204 : 1990 'Reciprocating internal combustion engines — Designation of the direction of rotation and of cylinders and valves in cylinder heads, and definition of right-hand and left-hand in-line engines and locations on an engine' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Automotive Primemovers Transmission, Steering Systems and Internal Combustion Engines Sectional Committee and approval of the Transport Engineering Division Council.

The Sectional Committee decided to align the Indian Standard with the corresponding International Standard wherever feasible and wherever the domestic considerations were not so intense so as to have standards different from the ISO Standards. This decision was taken with a view to upgrade the quality of the products in-line with the International Standards.

The second edition of the above ISO Standard cancels and replaces the first edition (ISO 1204 : 1972) as well as ISO 1205 : 1972, ISO 2276 : 1972 and ISO 3249 : 1975. These standards have been combined into one standard and new clause covering the designation of valves in cylinder heads of reciprocating Internal Combustion engines has been added.

In view of above IS 7451 (Part 3) : 1974, IS 7451 (Part 4) : 1974 and IS 7451 (Part 5) : 1975 are amalgamated into IS 7451 (Part 2).

This standard was first published in 1974. The first revision was undertaken due to revision of the base standard as indicated above. The following technical changes have been incorporated:

- a) Position of the observer is explained in detail.
- b) New clause on designation of valves (7) and designation of valves in cylinder heads (4.2) have been included.

The text of the ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
- b) Comma(,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Indian Standard

RECIPROCATING INTERNAL COMBUSTION ENGINES

PART 2 DESIGNATION OF THE DIRECTION OF ROTATION AND OF CYLINDERS AND VALVES IN CYLINDER HEADS, AND DEFINITION OF RIGHT-HAND AND LEFT-HAND IN-LINE ENGINES AND LOCATIONS ON AN ENGINE

(First Revision)

1 Scope

This International Standard specifies methods of designating the direction of rotation and the cylinders of reciprocating internal combustion engines and of designating a specific valve in a cylinder head when the cylinder head is mounted on the engine or dismantled.

It defines right-hand and left-hand in-line reciprocating internal combustion engines and locations on a reciprocating internal combustion engine so that the position of equipment on the engine can be described.

It applies to reciprocating internal combustion engines for land, rail-traction and marine use, excluding engines used to propel agricultural tractors, road vehicles and aircraft. It may be applied to engines used to propel road-construction and earth-

moving machines, industrial trucks and for other applications where no suitable International Standard for these engines exists.

2 Definitions of locations on an engine

For the purposes of this International Standard, the following definitions apply (see figure 1).

NOTE 1 For the position of the observer, see clause 4.

2.1 driving end: The portion of the engine which is substantially nearest to the observer.

2.2 free end: The portion of the engine which is substantially most remote from the observer.

2.3 left side: The portion of the engine which is substantially on the left of the engine as viewed by the observer.

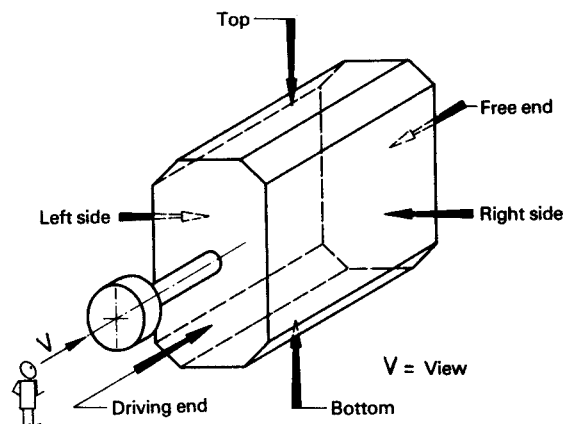


Figure 1 — Locations on an engine

2.4 right side: The position of the engine which is substantially on the right of the engine as viewed by the observer.

2.5 top: The portion of the engine which is substantially at the top of the engine as viewed by the observer.

2.6 bottom: The portion of the engine which is substantially at the bottom of the engine as viewed by the observer.

NOTE 2 In the case of an engine with a vertical driving shaft, it is not possible to determine the left side, right side, top and bottom. The definition of driving end only may be used and other locations must be described by the manufacturer by reference to easily identifiable components.

2.7 operating side: The portion of the engine where the engine is started, controlled during the operation and stopped.

2.8 exhaust side: The portion of the engine where the exhaust manifold is located.

3 Direction of rotation

The direction of rotation is illustrated in figure 2.

NOTE 3 The direction of rotation of a reciprocating internal combustion engine is the direction of rotation of the shaft which provides the engine driving shaft extremity, as viewed from the position of the observer defined in 4.1.1.

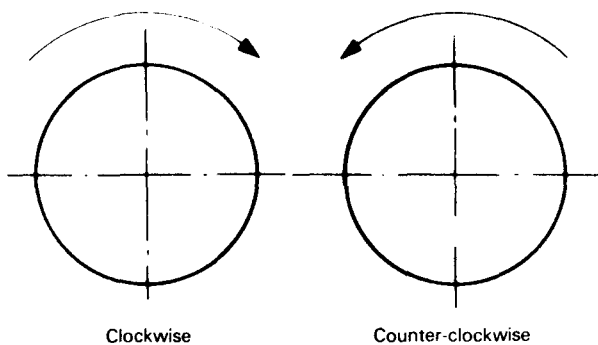


Figure 2 — Direction of rotation

4 Position of the observer

4.1 Designation of direction of rotation and of cylinders

The position and direction of view of the observer when designating the direction of rotation and the cylinders, and when defining in-line engines as right-hand or left-hand and the locations on an engine shall be as given in 4.1.1 to 4.1.3.

4.1.1 The position of the observer in relation to an engine is considered to be an extension of the axis of the shaft which provides the driving extremity, the observer directing his view towards this shaft extremity along the arrow V (see figure 3).

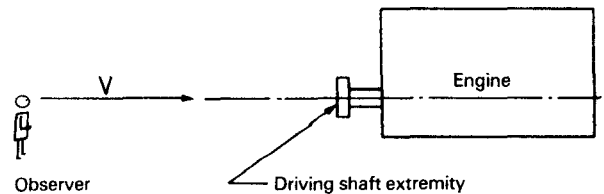


Figure 3 — Position of the observer

This position applies equally to an engine with an integral (built-in) reversing gear with or without speed variation, and to an engine with an integral (built-in) gear with or without speed variation. The position of the observer shall be determined relative to the visible driving shaft extremity.

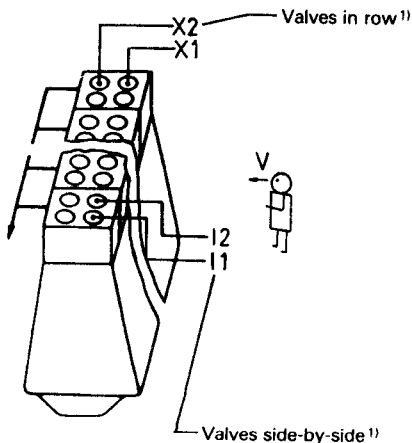
4.1.2 The position of the observer relative to an engine with more than one bank of cylinders shall, in accordance with 4.1.1, be determined relative to the main shaft through which (inside the engine) the total power of all cylinders is transmitted.

4.1.3 If the engine has more than one driving shaft extremity, the manufacturer shall state which shaft extremity is referred to when designating the direction of rotation and the cylinders, and when defining in-line engines as right-hand or left-hand and the locations on an engine.

4.2 Designation of valves in cylinder heads

The position and direction of view of the observer when designating the valves in cylinder heads shall be as given in 4.2.1 to 4.2.3.

4.2.1 For in-line engines, the position of the observer is considered to be to the side of the cylinder bank opposite to the side on which the exhaust manifold is located, the observer directing his view towards the valves of one cylinder (see figure 4).



1) See clause 7 for the designation of valves

Figure 4 — Position of observer for in-line engine

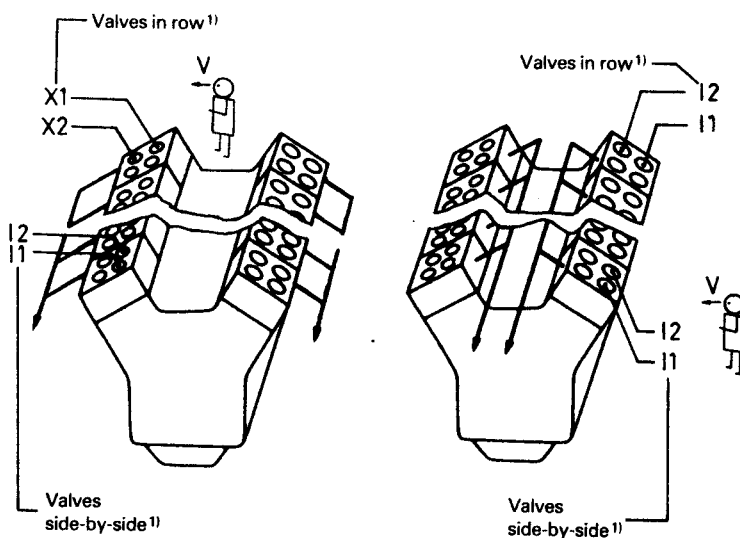
4.2.2 For V-, twin-bank and opposed-cylinder engines, the position of the observer is considered to be to that side of any one cylinder bank opposite to the side on which the exhaust manifold is located, the observer directing his view towards the valves of one cylinder in the cylinder bank nearest to him (see figure 5).

4.2.3 Engines with a vertical crankshaft, inclined engines and horizontal engines shall be given an imaginary rotation until the crankshaft is horizontal and the engine in a vertical position with the cylinders above the shaft which provides the driving extremity. On opposed-cylinder engines, after rotation into an imaginary vertical position to bring the crankshaft horizontal, the observer is considered as directing his view towards the cylinders above the crankshaft when standing facing the bottom side of the engine.

5 Designation of direction of rotation

5.1 The direction of rotation shall be designated as clockwise or counter-clockwise (see figure 2) from the position described in clause 4 for a hypothetical observer giving the description.

5.2 If the engine can rotate in either direction, the manufacturer shall state the preferred direction, if any.



1) See clause 7 for the designation of valves

Figure 5 — Position of observer for V-engines

6 Designation of the cylinders

It is assumed that in all the mechanisms described below, the cylinders are of identical design. Each individual cylinder of a reciprocating engine shall be designated by a number (numbering consecutively 1, 2, 3, etc.) or by a combination of a capital letter (lettering consecutively A, B, C, etc.) and a number.

6.1 In-line engines

Each individual cylinder of an in-line (single bank) engine shall be designated by numbers only, starting with number 1 for the cylinder nearest the observer (see clause 4), then number 2 for the next cylinder, etc. [see figure 6 a), b) and c)].

The cylinder of a single-cylinder engine shall be designated by the number 1.

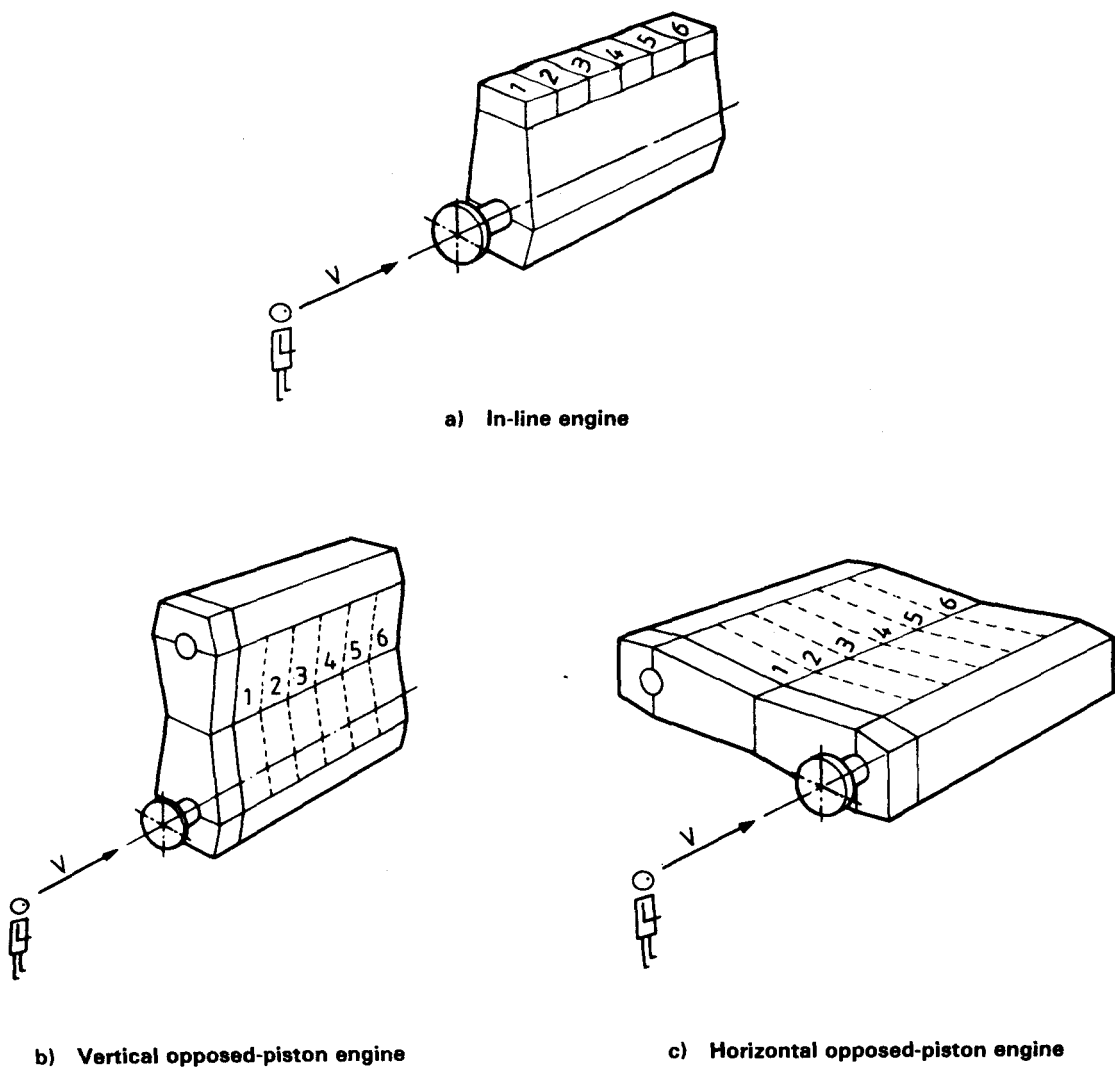


Figure 6 — Examples of the designation of cylinders of in-line engines

6.2 Engines with more than one bank

6.2.1 Individual cylinders of an engine with more than one bank (see figure 7) shall be designated by combinations of a capital letter and a number, for example A1, B6, D6.

The letters shall be allocated by taking an imaginary semi-plane P centred upon the axis of the driving crankshaft. (This crankshaft is assumed to be in a horizontal position.) The semi-plane P is imagined to be rotating in a clockwise direction.

The starting position of this semi-plane shall be horizontal and to the left (i.e. in the 9 o'clock position) of the observer (see clause 4).

The first bank through which this clockwise-rotating semi-plane moves, including a bank at the starting

position, shall be designated by the capital letter A, the following bank by the capital letter B, etc. [see figure 8 a) to h)].

6.2.2 Each individual cylinder shall be designated by a combination of a capital letter (as determined in 6.2.1) followed by a number (as determined in 6.1 for in-line engines).

A single-row engine shall be designated A1, B1, C1, etc. [see figure 8 d)].

6.2.3 For multi-crankshaft engines with more than one bank, the axis of rotation of the semi-plane shall be the central line between all the crankshafts, i.e. the line that coincides with the line of the arrow V [see figure 8 e) to h)].

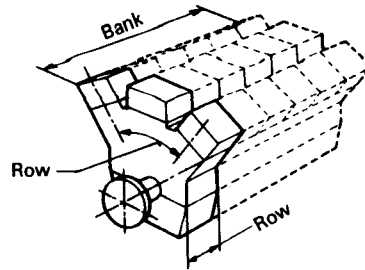


Figure 7 — Typical multibank engine

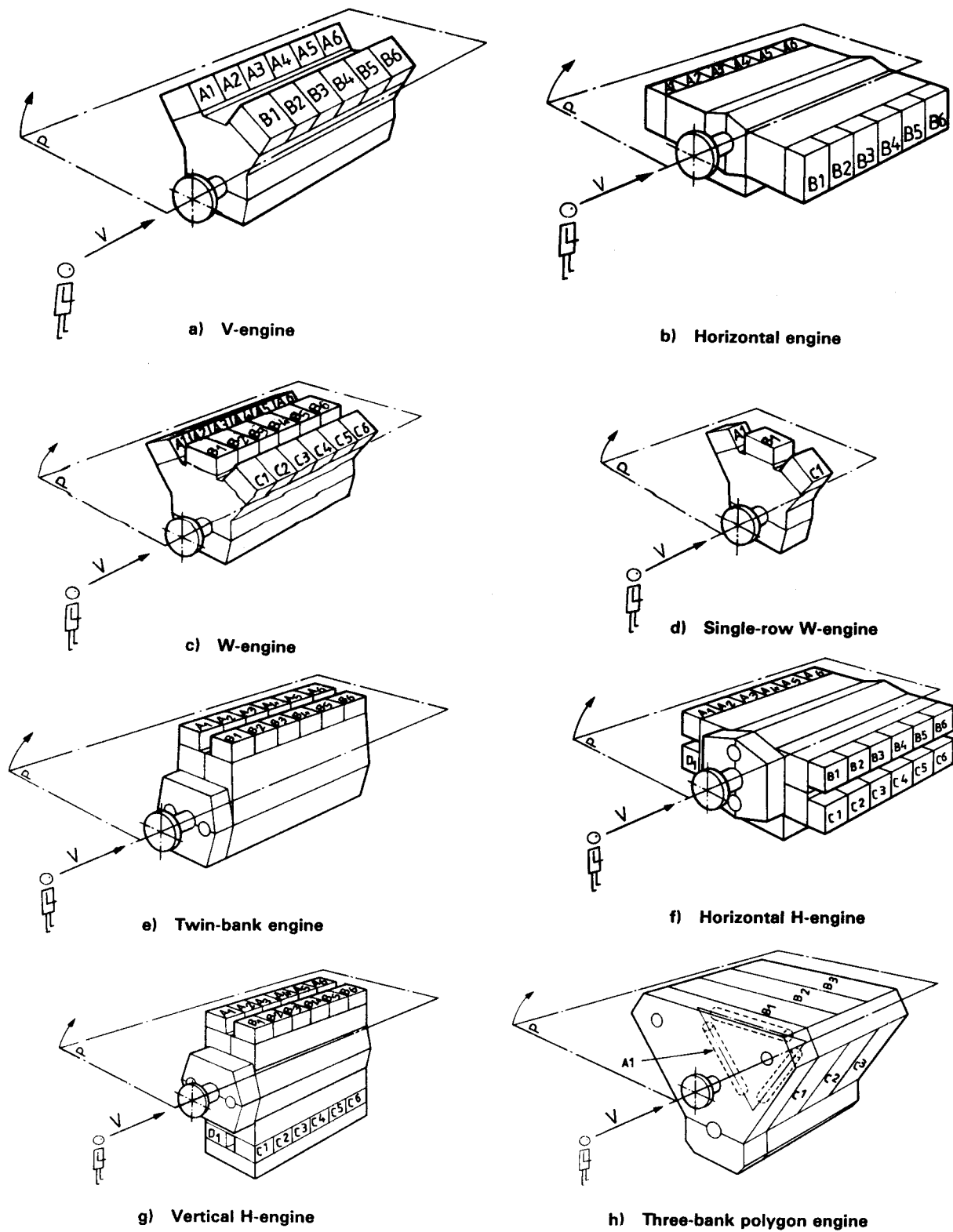


Figure 8 — Examples of the designation of cylinders of engines with more than one bank

6.2.4 In the case of an engine with a vertical crankshaft, it is not possible to determine the 9 o'clock position of the rotating semi-plane. The clockwise lettering of the banks of this type of engine shall start from the position of any readily identifiable component chosen by the manufacturer, for example the fuel control. The cylinder numbers shall be determined as described in 6.1 for in-line engines (see figure 9).

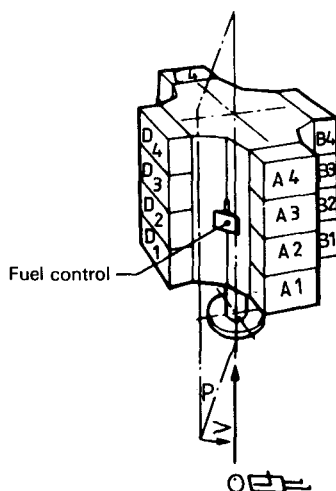


Figure 9 — Vertical crankshaft X-engine

7 Designation of the valves

According to the position and direction of view of the observer, the valves are designated 1, 2 or 3, exhaust or inlet valve, depending on the design arrangement and counting from left to right or from front to back (see figure 4 and figure 5).

Individual cylinder heads or, if required, cylinder banks shall be designated in accordance with clause 6.

NOTES

4 The method covers engines with poppet valves and with no more than two cylinder banks.

5 If required, the following abbreviations may be used and each valve may be marked accordingly (see figure 10 and figure 11):

X: exhaust
I: inlet

6 If required, a mark may be placed on each cylinder head to show the observer's direction of view and to in-

dicate the exhaust side. For example, this could be an arrow pointing in the observer's direction of view, placed at the side of the cylinder head where the exhaust valves are located. It is recommended that the mark be on that face of the cylinder head which carries the mechanism operating the valves (see figure 10 and figure 11).

Examples of the designation of valves are shown in figure 12.

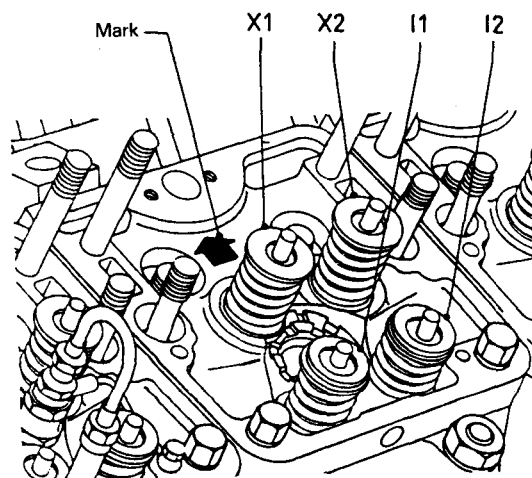


Figure 10 — Inlet valves near to observer, exhaust valves away from observer (example for valves side-by-side, exhaust manifold inside V-engine)

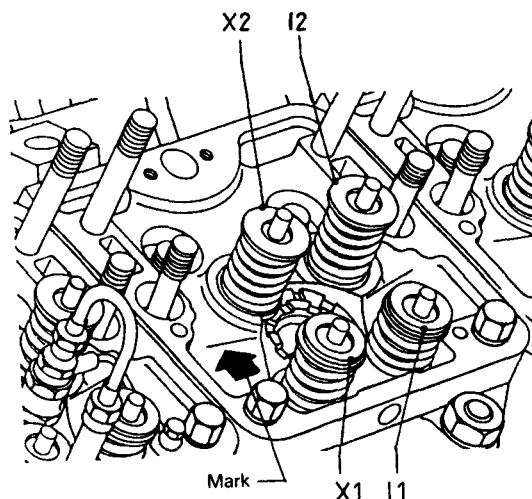
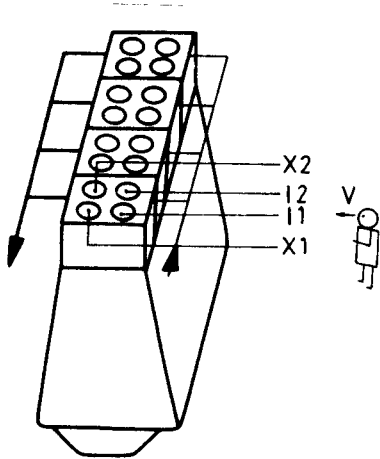
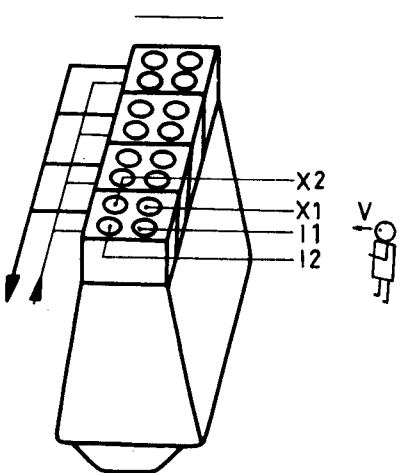


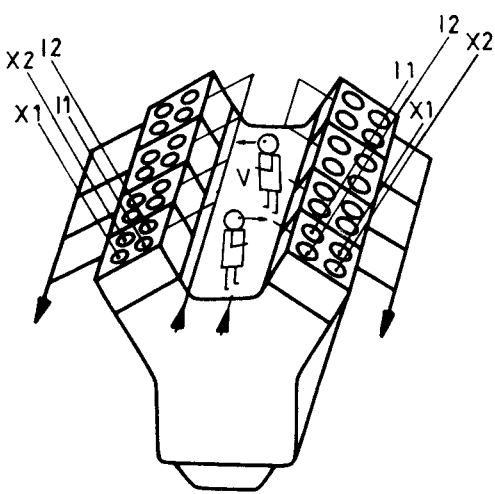
Figure 11 — Inlet valves at right, exhaust valves at left of observer (example for valves in row, exhaust manifold inside V-engine)



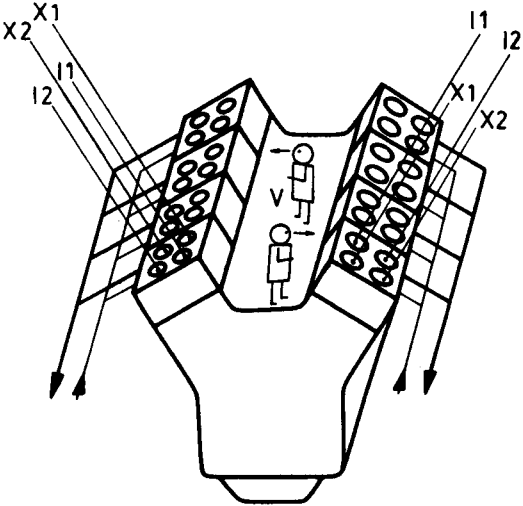
a) Inlet valves near to observer, exhaust valves away from observer, valves side-by-side, in-line engine



b) Exhaust valves at right, inlet valves at left of observer, valves in row, in-line engine



c) Inlet valves near to observer, exhaust valves away from observer, valves side-by side, exhaust manifold outside, intake manifold inside V-engine



d) Exhaust valves at right, inlet valves at left of observer, valves in row, exhaust and intake manifold outside V-engine

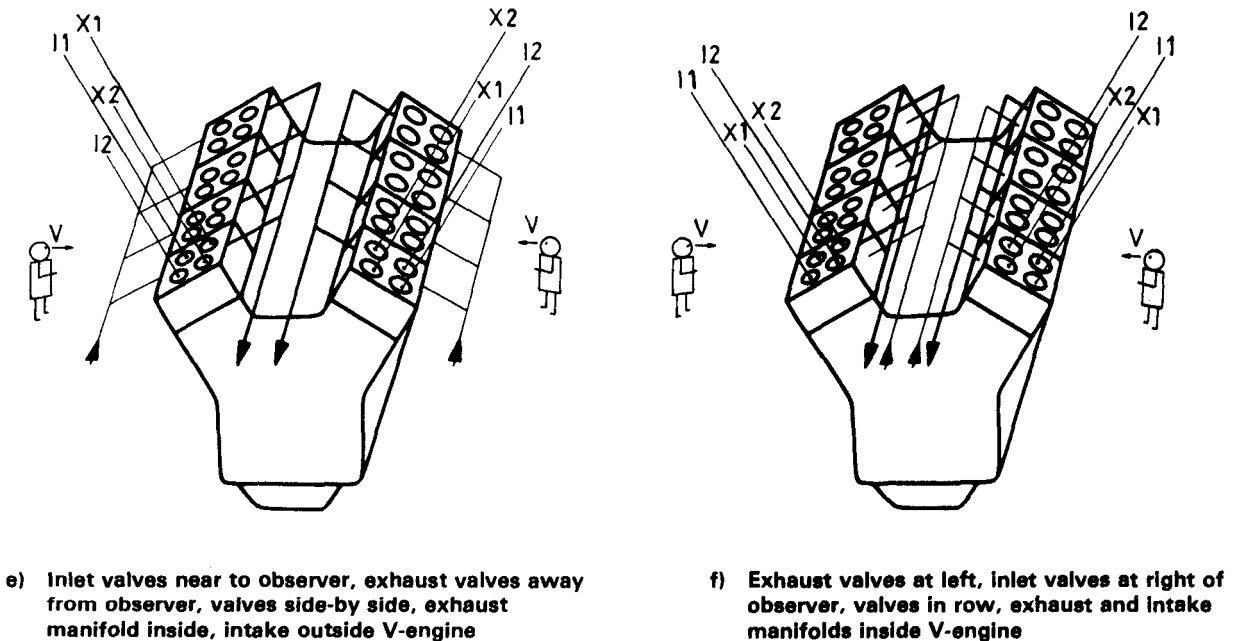


Figure 12 — Examples of the application of the valve designation method

8 Definition of right-hand and left-hand in-line engines

The location of the exhaust pipes is the deciding factor in defining right-hand and left-hand in-line engines.

NOTES

7 The exhaust pipes are used as the datum for this designation only when there is one single set of exhaust pipes, the centreline of which does not lie in the plane which contains the cylinder centres. (The figures show one exhaust pipe only.)

8 The definition of right-hand and left-hand in-line engines is determined in relation to the position of an observer, and only applies where the exhaust pipes are on one side of the engine.

8.1 In-line engines with vertical cylinders located above the shaft which provides the driving extremity

8.1.1 Right-hand in-line engine

A right-hand in-line engine is any engine with the exhaust pipes located to the right of the plane which contains the cylinder centres, as viewed from the observer's position described in 4.1.1 [see figure 13 a) and c)].

8.1.2 Left-hand in-line engine

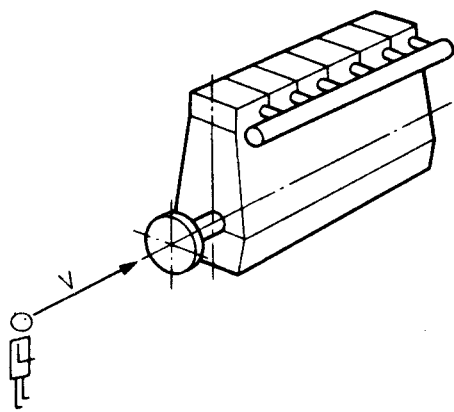
A left-hand in-line engine is an engine with the exhaust pipes located to the left of the plane which contains the cylinder centres, as viewed from the observer's position described in 4.1.1 [see figure 13 b) and d)].

8.2 In-line engine with a cylinder arrangement other than that in 8.1

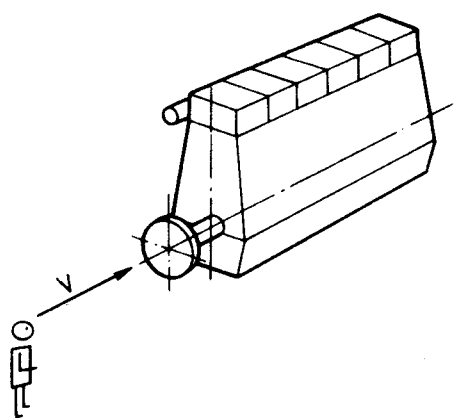
An in-line engine in which the cylinders are not located in a vertical plane above the shaft which provides the driving extremity shall be given an imaginary rotation about the axis of this shaft until they are in such a position.

In accordance with 8.1, the engine is then designated according to the location of the exhaust pipes as a right-hand in-line engine [see figure 14 a), c) and e)] or a left-hand in-line engine [see figure 14 b), d) and f)].

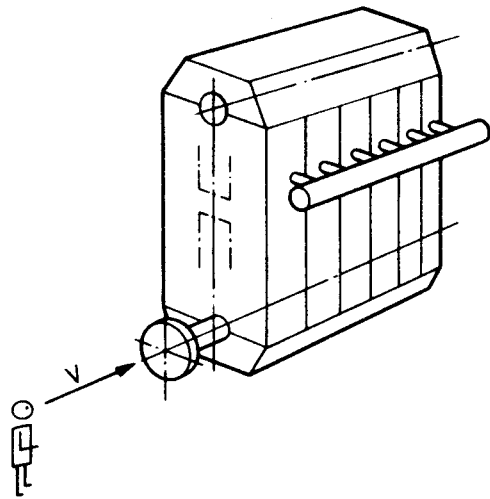
For opposed-piston engines as shown in figure 14 e) and f), the imaginary rotation of the engine about the axis of the shaft which provides the driving extremity shall be such that the cylinder parts to which the exhaust pipes are connected will be in a vertical position above this shaft.



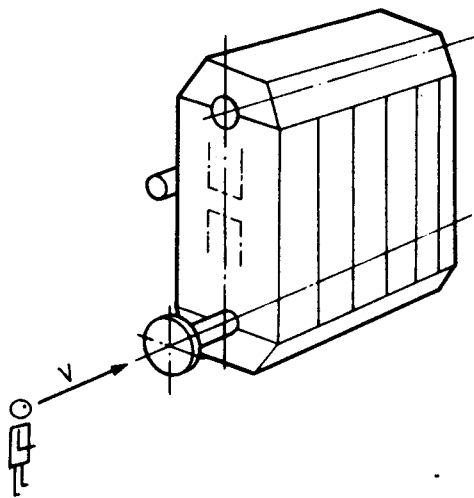
a) Right-hand single-bank engine



b) Left-hand single-bank engine

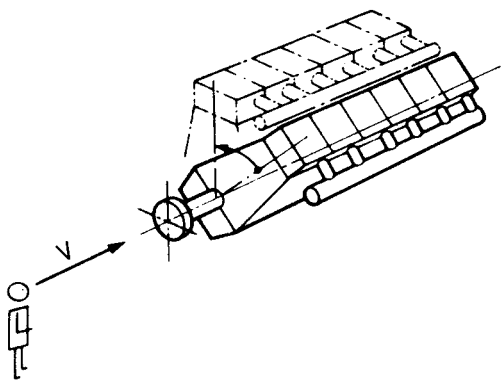


c) Right-hand single-bank opposed-piston engine

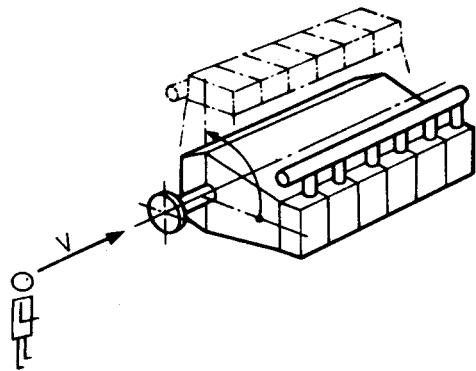


d) Left-hand single-bank opposed-piston engine

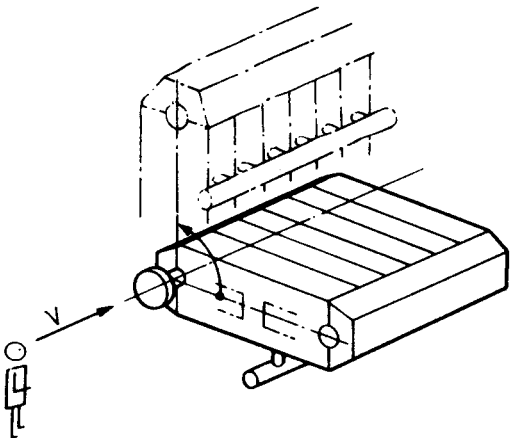
Figure 13 — In-line engines with vertical cylinders



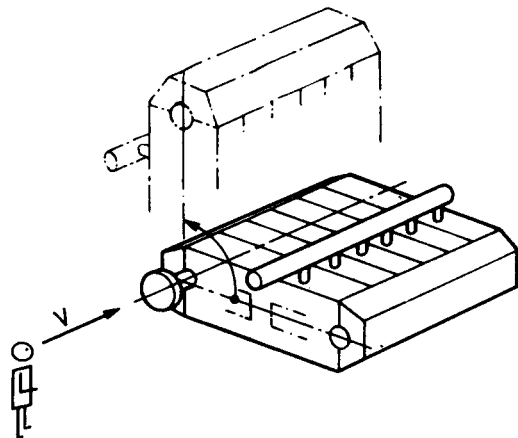
a) Right-hand single-bank engine



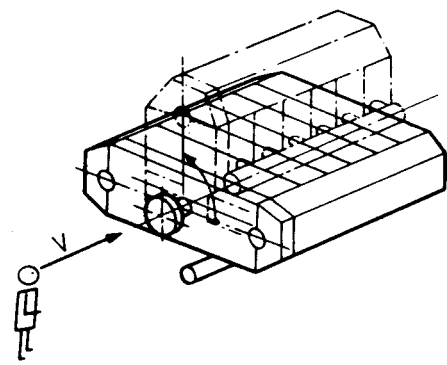
b) Left-hand single-bank engine



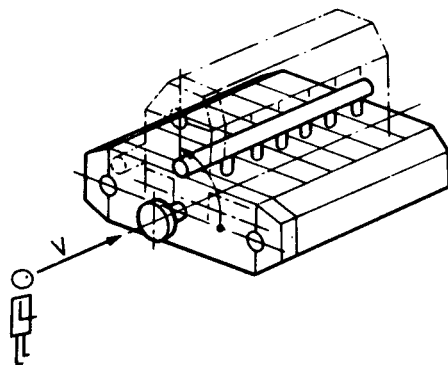
c) Right-hand single-bank opposed-piston engine



d) Left-hand single-bank opposed-piston engine



e) Right-hand single-bank horizontally opposed-piston engine



f) Left-hand single-bank horizontally opposed-piston engine

Figure 14 — In-line engines with cylinders other than vertical

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This Indian Standard has been developed from Doc : No. TED 2 (478).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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